Offer for a PHD position – Montpellier, France – 2013-2015

The French National Research Institute IRSTEA (ex Cemagref) offers a PhD position to make a research work in its centre of Montpellier (south of France). This position will be 100% funded by the Agropolis foundation (www.**agropolis-fondation**.fr/fr/accueil.html), for 3 years duration (project accepted).

PhD topic (project proposal)

Objectives

Hyperspectral imagery (HSI) can be a very valuable tool for plant phenotyping in field conditions, able to produce high resolution cartography of leaf chemical components. However, it requires robust calibrations by means of reference measurements over large set of samples. The objective of this project is to develop a comprehensive methodology for in-field phenotyping by HSI which:
- properly takes into account the various effects of plant 3D structure and lighting conditions on collected pixel spectra in the field.
- proposes spectrum analysis approaches (based on chemometrics) that are robust to these 3D/lighting effects

Plant phenotyping related to Mediterranean crop specific constraints will be the main applicative scope of the project.

Actions planned

The first action will be to deeply investigate the effect of 3D plant structure on spectra collected par HSI, starting from the intrinsic optical properties (reflectance, transmittance) of isolated leaves. For this purpose, 3D architecture models of plant crops, issued from the scientific community, will be combined with ray tracing tools to simulate in-field hyperspectral images.

Then, starting from large sets of individual leaves, for which agronomical reference measurements will be made in laboratory, the ray-tracing simulation tool will allow to generate virtual in-field spectra. From these virtual spectra, robust chemometrical models will be developed and evaluated.

Finally, these models will be assessed in real phenotyping actions, using hyperspectral cameras adapted for field imagery.

Expected outputs

- a better understanding of opto-physical phenomena involved in in-field hyperspectral imaging (publications)
- an operational hardware and software tool for high throughput in-field phenotyping, usable in various phenotyping platforms

Milestones and deliverables

Year 1:
- operational software tool for in-field HSI simulation

Year 2:
- opto-physical phenomena induced by 3D plant structure and associated black-box modelling assessment (journal publication)

Year 3:
- spectral data pre-processing adapted to in-field HSI (journal publication)
- PhD dissertation

Overall coherence and the role of the various partners

ITAP will bring its knowledge in hyperspectral imagery and chemometrics, and provide the required hardware (cameras, in-field acquisition system, etc.)

Other partners will be mainly involved in PhD supervision, bringing the following knowledge:

AGAP: plant phenotyping requirements and ecophysiology
EMMAH: agronomical sensors, optical properties of leaves
CSIC-IAS: mediterranean crops and associated constraints

Candidate profile:

<u>Agropolis foundation requirements:</u>
- candidates should not have resided or carried out their main activity (work, studies, etc) in France for more than 12 months in the 3 years immediately prior to the date of submission of the proposal (i.e. september 2012).
- candidates from or having worked in developing or emerging, Southern or Mediterranean countries are encouraged

<u>Scientific requirements:</u>
The candidate should have a background on signal and/or data processing, and a scientific interest in optics and related physics.

<u>Others:</u>
- fluent French or English.
- Experience in Matlab (or any programming language)
- Interested in agronomics and field experimentations

Start date

March 2013

Contact

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